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Design and Development of Hearing Aid System

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Abstract - *A hearing aid is a device that sits in or behind the wearer's ear and is designed to modulate and amplify the sound for the wearer. Devices which were used earlier were called ear trumpets or ear horns, were passive funnel-like cones which amplified sound and were designed to collect sound and direct it into the ear canal. The bone anchored d hearing aid, as well as cochlear inserts, are similar devices. Bluetooth open wireless technology for transmitting and transmitting and receiving dvtr over short distances (using short-wavelength radio transmission in ISM band) from fix a 24002480 MHz) from stationary and mobile devices. Originally designed as a wireless RS-232 data cable by telecommunications operator Ericsson in 1994 [1]. It can connect multiple devices and cause sync issues. Bluetooth Special Interest Group, which has more than 16,000 member companies in the area of telecommunication, computing, networking, and consumer electronics and security, manages Bluetooth. The SIG oversees the development of the specification, manages the program which qualifies and protects the trademarks. To be marketed as a Bluetooth device, it must be qualified according to the SIG's standards. The technology necessitates a network of patents, which are only licensed for those devices which qualify; hence, the protocol may be regarded as proprietary.*

Key Words: Wavelength, Signal to noise ratio, ISM band

1.INTRODUCTION

This project focuses on intelligent smart hearing aids that can adjust its sound amplifier in the environment. State-of-the-art technology was used to create a small low-power consuming smart hearing aid. Hearing aid circuits normally consume battery power continually when they are turned on. The developed technology saves battery power by only switching on the sound amplifier part of the system only when sound is detected by the mic.Hearing loss manifests itself in a variety of ways. The most common reason for hearing loss is related to the body's ageing process and exposure of the ear to high levels of sound energy for a long period of time. As one becomes older, it becomes more difficult to hear different sounds. The ear becomes less responsive to sound, low precision as sound level analyzer, and processes speech with less efficiency. Loss of hearing differs in different individuals. Changes in the ear happen slowly over time. However, by the time these changes are noticed, it is estimated that 30 to 50 percent or more of the sensory cells become and go through irreparable structural damage or are absent entirely. [1. The only option available to hearing-impaired individuals in these circumstances is to use a hearing aid. Hearing aid circuits that are readily available consume battery power on a continuous basis, and the circuitry is complex to design. In light of this factor, smart hearing aids have been developed in order to ensure low power consumption, as exemplified in [2, 3]. The 555 IC has been utilised as a mono-stable multivibrator and the p-amp has been used as a comparator in this system. This is a complex circuit to design with very low accuracy. We've devised an appealing approach: a low power consuming-microcontroller run smart hearing aid that saves the battery power. The sensitivity of the detection section as well as the "on time duration" can be modified by programming the microcontroller. The circuit is designed to employ only a single condenser microphone for sound detection and amplification.

1.1 Literature Review

The Human Ear: In the human body, the ear is the organ that allows us to listen to sounds. The functions include collecting, transferring, and transducing sound to the brain through various sections. The inner ear, middle ear, and outer ear are the three parts of the ear. A pinna and the ear canal make up the outer ear[1]. The ossicles and the tympanic cavity make up the middle ear. The vibration travels through the oval window and the fluid in the cochlea in the inner ear, stimulating hundreds of microscopic hairs and resulting in the production of an electrical impulse that is received by the brain.Types of Hearing Loss[2] Deafness is characterised by the loss of hearing functions. A congenital abnormality, accident, disease, medicine, loud noise exposure, or age-related wear and tear are all possible causes. This means that humans cannot hear noises until they reach a decibel level of 90.

The type of hearing loss depends on which part of the ear is damaged. There are 3 types:

- Conductive hearing loss occurs when sound is unable to flow between the outer and middle ear. Soft sounds may be difficult to hear. It can be fixed with the help of medicine or surgery.

- Sensorineural hearing loss is caused by injury to the inner ear. It is the most prevalent type of hearing loss that is permanent.

- Mixed Hearing Loss - This indicates that both the outer and inner ear have been damaged. The outer ear is unable to transmit sound to the inner ear, and the inner ear is unable to convert sound into an electrical pulse.

1.2 Present Curative Measures

Hearing Aids: There are many types of hearing aids (also known as hearing devices), varying in size, intensity and design. Among the various sizes and models are:

1. Body worn aids
2. Behind the ear aids
3. Receiver in canal aids
4. Ear Molds
5. Cochlear Implants

2. WORKING PRINCIPLE

A cochlear implant may be beneficial if the eardrum and middle ear are in good working order. It's a thin electrode that's implanted into the cochlea and stimulates electricity via a tiny microcontroller hidden behind the skin behind the ear Telephones and hearing aids can communicate with each other in two ways: Acoustically, the microphone in the hearing aid picks up the sound from the phone's speaker. The signal inside the phone's speaker is picked up electromagnetically by the hearing aid's "telecoil" or "T-coil," a particular loop of wire inside the hearing aid. The telecoil picks up a weak electric field made of an existing voice coil on the phone speaker as it presses the speaker clamp back and forth. The Telecoil connection has nothing to do with the radio on a cell phone or wireless: the sound signal carried by the telecoil is a weak electric field made of a voice coil in the phone speaker as it presses the speaker plug back and forth.

In most cases, the electromagnetic (telecoil) method exceeds the acoustic method. This is because while the hearing aid is in telecoil mode, the microphone is turned off immediately, so the background sound is not upgraded. The sound is clear and distortion is rare because there is an electronic link to the phone. The phone must be a helper for this to work. For more technology, the phone speaker needs to have a voice coil producing a powerful electromagnetic field. Powerful coil speakers are more expensive and require more power than the smaller ones found on most modern phones; phones with low-power microphones fail to connect electrically and telecoil to the hearing aid, forcing the hearing aid to return to acoustic mode. When using the telecoil, most cell phones emit high levels of 40 percent of the audio, creating audible auditory aids. Connecting the cable (not Bluetooth) to the phone addresses this issue on most phones; with headsets placed near the hearing aid, the phone may be held far enough away to reduce static.

3. DESIGN CONSIDERATION

1. Condenser Microphone
2. Earphone
3. Amplification Section
4. Sound Detection Section

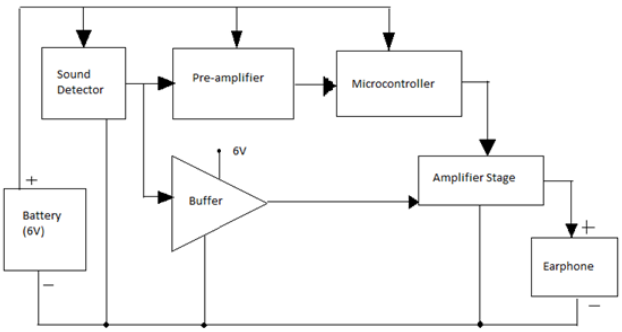

Fig -1: Block Diagram

4. RESULTS & CONCLUSIONS

We used an internal comparator and A/D converter for the microcontroller to bypass the complicated comparator and A/D converter circuit. In addition, the internal frequency was able to avoid the external oscillator circuit.

As a result, the designed software is responsible for the entire system's operation. The circuit is basic and compact in design. Electronic technology has become much less expensive in recent years, while biomedical equipment has remained prohibitively pricey. All intended components and instruments are, nevertheless, affordable due to the rapid development of microelectronics.

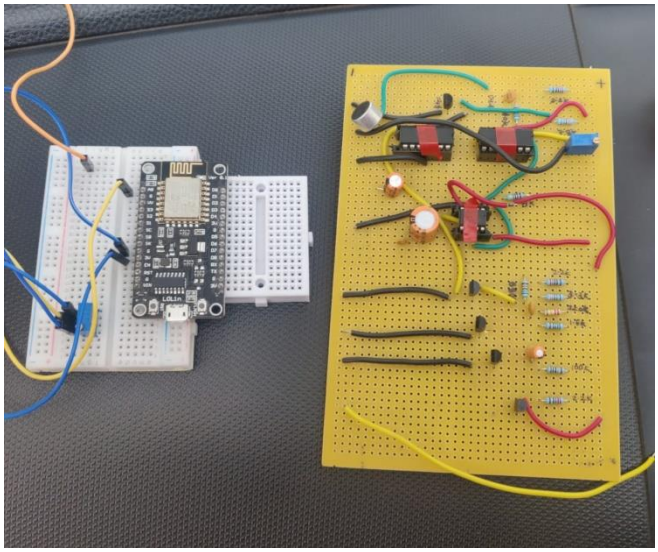

Fig. 6 Circuit Built

Furthermore, when the current system's features are compared to the developed system's, the latter appears as the better alternative in terms of cost, mobility, and design. Many users, particularly in developing nations, will be able to use the proposed equipment.

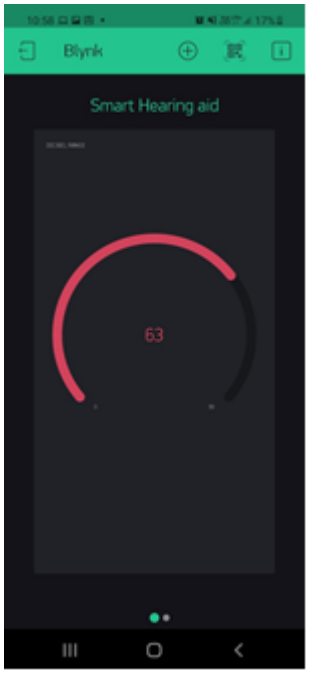

Fig. 7 Sensitivity reading on Blynk App

In this sense, a framework has been described in which the produced system is low power, low cost, and high precision. The developed system was put to the test and found to be trustworthy and satisfactory. In addition, a comparison of the features of various types of hearing aids now in use. It shows that the developed system is of better choice in terms of power consumption, cost, portability and design Thus, the entire system function depends on the developed software. The circuit design is simple and compact. In recent times, the cost of electronic equipment has fallen significantly, though bio-medical equipment remains expensive. However due to the rapid development of microelectronics, all designed components and instruments are inexpensive. Moreover, when the features of the presently used system are compared with the developed system, the latter emerges as a better choice in terms of cost, portability and design. Particularly in developing countries, the use of the deigned instruments will be accessible for many users.

A framework has been presented in this sense that the developed system is of low power consumption, low cost and high accuracy. The developed system has been tested and found to be reliable and satisfactory. Besides, a comparison on the features of different types of presently used hearing aid. It shows that the developed system is of better choice in terms of power consumption, cost, portability and design.

5. FUTURE SCOPE

This system can further be modified to get 100% noise cancellation. It can also be connected to different devices like television, mobile phones, computers etc. Remote or application control can be enabled to control sensitivity and sound levels.

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